

Claims:

1. A liquid crystal device comprising a layer of a liquid crystal material contained between two spaced cell wall carrying electrodes structures and an alignment treatment on at least one wall,
- characterised by
- means for reducing anchoring energy at the surface alignment on one or both cell walls.
2. The device of claim 1 wherein the means for reducing energy is an oligomer or short chain polymer within the liquid crystal material at the cell walls.
3. The device of claim 1 wherein the means for reducing energy is an oligomer containing esters, thiols, and/or acrylate monomers within the liquid crystal material at the cell walls.
4. The device of claim 2 wherein the oligomer or short chain polymer has imperfect solubility in the liquid crystal material.
5. The device of claim 2 wherein the oligomer or short chain polymer has a physical affinity for the surface of the cell wall.
6. The device of claim 2 wherein the oligomer or short chain polymer retains a substantially liquid like surface at the polymer and liquid crystal material interface
7. The device of claim 2 wherein the oligomer or polymer is substantially non-crystalline within the liquid crystal material.
8. The device of claim 2 wherein the oligomer or polymer reduces the liquid crystal material order parameter at or adjacent the cell walls.

9. The device of claim 2 wherein the oligomer or polymer changes the phase of the liquid crystal material at or adjacent the cell walls.
10. The device of claim 2 wherein the oligomer or polymer has a glass transition temperature below the operating temperature range of the device.
11. The device of claim 2 wherein the oligomer or polymer is substantially linear or includes branch points, either with or without crosslinking.
12. The device of claim 2 wherein the oligomer or polymer has a number of repeat units within the range of 4 to 1000.
13. A method of making a liquid crystal device comprising the steps of:-
- providing a layer of a liquid crystal material contained between two spaced cell wall carrying electrodes structures and an alignment treatment on at least one wall,
- characterised by
- the step of reducing anchoring energy at the surface alignment on one or both cell walls.
14. The method of claim 11 wherein the oligomer or short chain polymer is formed by polymerisation of reactive low molecular weight materials in solution in the liquid crystal fluid.
15. The method of claim 11 wherein the oligomer or short chain polymer is formed by polymerisation of reactive low molecular weight materials in solution in the liquid crystal material prior to its introduction between the cell walls.
16. The method of claim 11 wherein the oligomer or short chain polymer is formed by polymerisation of reactive low molecular weight materials in solution in the liquid crystal material after to its introduction between the cell walls.

17. The method of claim 11 wherein the oligomer or short chain polymer is formed by polymerisation of reactive low molecular weight materials in the presence of an inert solvent which is then removed and the resulting polymer dissolved in the liquid
5 crystal material prior to its introduction between the cell walls.

18. A twisted nematic liquid crystal device capable of being switched from a twisted
stated to a non twisted state comprising;

10 two cell walls enclosing a layer of nematic liquid crystal material;

electrode structures on both walls for applying an electric field across the liquid
crystal layer;

15 a surface alignment on both cell walls providing alignment direction to liquid crystal
molecules and arranged so that a twisted nematic structure is formed across the liquid
crystal layer;

means for distinguishing between the two different optical states of the liquid crystal
20 material;

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means for reducing zenithal anchoring energy in the surface alignment on one or both
25 cell walls.

19. The device of claim 18 wherein the means for reducing zenithal anchoring energy
is an oligomer which is coated onto the inner surface of one or both cell walls either
spread on the surface or added to the liquid crystal material.

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20. The device of claim 18 wherein the means for reducing and zenithal anchoring
energy is an oligomer incorporated in the liquid crystal material.

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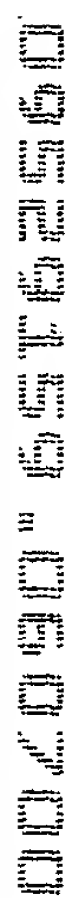
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BVE (Butyl vinyl ether)



EGTG (Ethylene glycol bis(thioglycollate))



NDT (Nonane-1,9-dithiol)

5 37. The device of claim 35 wherein the oligomer is an amount up to 10.% by weight in the liquid crystal material.

38. The device of claim 35 wherein the chain length (n) is less than 100 repeat units.

10 39. The device of claim 35 wherein the oligomer's parameters of type, concentration, chain length, are arranged to reduce the liquid crystal order parameter at or adjacent the cell wall.

15 40. The device of claim 35 wherein the oligomer's parameters of type, concentration, chain length, are arranged to change the phase of the liquid crystal material at or adjacent the cell wall.

41. The device of claim 35 wherein the oligomer is a material is a material that has been precured prior to introduction between the cell walls.

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42. The device of claim 35 wherein the oligomer is a material that has been precured after introduction between the cell walls.

25 43. The device of claim 33 wherein the surface alignment is provided by a bigrating surface.

44. A smectic liquid crystal device comprising:

30 a liquid crystal cell including a layer of smectic liquid crystal material contained between two walls bearing electrodes and surface treated to give both an alignment and a surface tilt to liquid crystal molecules;

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means for reducing anchoring energy at the surface alignment on one or both cell walls.

5 45. The device of claim 44 wherein the means for reducing energy is an oligomer or short chain polymer within the liquid crystal material at the cell walls.

46. The device of claim 44 wherein the means for reducing energy is an oligomer containing esters, thiols, and/or acrylate monomers within the liquid crystal material
10 at the cell walls.

47. The device of claim 45 wherein the oligomer or short chain polymer has imperfect solubility in the liquid crystal material.

15 48. The device of claim 45 wherein the oligomer or short chain polymer has a physical affinity for the surface of the cell wall.

49. The device of claim 45 wherein the oligomer or short chain polymer retains a substantially liquid like surface at the polymer and liquid crystal material interface
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50. The device of claim 45 wherein the oligomer or polymer is substantially non-crystalline within the liquid crystal material.

51. The device of claim 44 wherein the oligomer or polymer reduces the liquid
25 crystal material order parameter at or adjacent the cell walls.

52. The device of claim 44 wherein the oligomer or polymer changes the phase of the liquid crystal material at or adjacent the cell walls.

30 53. The device of claim 44 wherein the liquid crystal material is a chiral smectic material, the alignment directions on the two cell walls are substantially parallel, and the device is a bistable device.

55. The device of claim 44 wherein the liquid crystal material is a non-chiral smectic material.

56. The device of claim 44 wherein the liquid crystal material is a smectic A material.

57. The device of claim 44 wherein the alignment is provided by a grating surface.

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58. The device of claim 44 wherein the alignment is provided by a rubbed polymer surface.

59. The device of claim 44 wherein one cell wall has an alignment treatment, the
15 other cell wall has no azimuthal alignment direction, and both cell walls are treated
with the means for reducing anchoring energy.

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